DNA - What It Is and How It Works

Scientists say that DNA is the instruction manual for how to build life, but what does that really mean? Can we create a dinosaur in a lab (like the Hammond Lab in Jurassic World) or use the DNA of one species to genetically engineer another?

Before we can answer those questions, we have to examine DNA itself. What is it—and—how does it work?

BBC Knowledge and Learning has released a video explainer, with animation, about DNA. In about three minutes, we can learn much from this clip:

> *DNA—short for Deoxyribonucleic Acid—is the instruction manual for how to build life from microbes to plants to human beings. It defines us all.*
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> *The complete set of instructions, encoded in an organism's DNA is called its genome and is passed from parent to offspring during reproduction.*
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> *Information is stored in DNA, using just four types of molecules which occur in pairs. There are billions of these pairs organized in a double-helix structure that is both strong and compact. These pairs also allow each strand to act as a backup for the other—a remarkably efficient way to safeguard this precious genetic information.*
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> *DNA folds into paired packages called chromosomes that are stored in the nucleus of the cell. Different species have different numbers of chromosomes. Humans have 23 pairs.* [The 23rd pair determines whether a person is male or female.]
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> *Chromosomes contain many genes. A gene is a section of DNA that holds the instructions for a protein. Proteins are essential for life and perform a huge variety of jobs—from controlling the function of a single cell to determining the shape of the whole organism.*
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> *Within a species, each organism has very similar DNA. In human beings, the difference between one person and another is a fraction of one percent—but it's what makes us individuals, giving us different facial features, hair color and height. The uniqueness of our DNA can be used like a fingerprint to identify us with an extraordinary degree of accuracy.*
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> *By reading DNA, scientists have discovered that we share sequences not just with our own species but with every other living thing on earth. Chimpanzees, one of our closest living relatives, share about 96% of our DNA. But ... we also have genes in common with fish, plants and bacteria—powerful evidence that all life came from a single universal ancestor many, many years ago.*
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> *We haven't just learned how to read the instruction manual for life, we can rewrite it as well. People have been manipulating DNA since before we knew it existed, selectively breeding plants and animals to bring out desirable traits.*
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> *Now, genetic engineering allows us to directly alter DNA in the lab, creating new varieties of life—from plants that can resist disease, or drought, to bacteria that can mass-produce life-saving hormones.*
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> *But ... we don't yet know what all of DNA does. Lengthy sequences make no proteins at all and have, perhaps mistakenly, been labeled "junk."*
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> *Some people are worried about these gaps in our knowledge and unforeseen problems they believe genetically modified organisms may cause.*
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> *What's clear is that the instruction manual for life is more subtle, elegant and complex than we could have possibly imagined.*
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> *DNA has revealed many of its secrets, but we still have much to learn.*

So ... now you know the *basics* of DNA and how it works.

Credits:

For more information about this particular clip, see the following:

BBC Knowledge and Learning is exploring a wide variety of topics from social history to science in a series of three-minute online Explainer documentaries, and commissioned Territory (territorystudio.com) to produce an animated film on the subject of DNA.

As Will Samuel, lead designer and animator on the project explains, the approach taken wasn't just to look into a scientific future. "We needed to find a graphic style to communicate the beauty and intricacy of DNA. We wanted to create nostalgia; taking the audience back to the days of textbook diagrams and old science documentaries, such as Carl Sagan's COSMOS and IBM's POWER OF TEN (1977). Using the double helix circular theme as a core design we focused on form, movement and colour to create a consistent flow to the animation, drawing on references from nature, illustrating how DNA is the core to everything around us."

Three minutes is a short time to explore a subject where most doctorates only scratch the surface, so writer Andrew S. Walsh teamed up with molecular biologist Dr Matthew Adams to distil the script down to the most fundamental elements required to understand not only DNA's form and function but how our understanding of these discoveries has affected the wider world. While this length may feel restrictive, the team found that this limitation acted as a lens, focusing the piece on the essentials.

The Explainer series is designed to intrigue and inform, encouraging those who discover the documentaries to further explore through links to additional information found on the BBC website.

Client: Richard Cable for BBC Knowledge & Learning
Studio: Territory Studio

Creative director: David Sheldon-Hicks
Art and animation director: William Samuel
Producer: Sam Hart
Script Editor: Richard Cable
Writer and VO director: Andrew S Walsh
Scientist: Dr Matthew Adams
Animators: Alasdair Willson, David Penn, Marti Romances, William Samuel
VO actor: Simon Poland (justvoicesagency.com)
Sound design: Room 24 (room-24.com)

See Alignments to State and Common Core standards for this story online at:
http://www.awesomestories.com/asset/AcademicAlignment/DNA-What-It-Is-and-How-It-Works

See Learning Tasks for this story online at:
http://www.awesomestories.com/asset/AcademicActivities/DNA-What-It-Is-and-How-It-Works